U. S. DEPARTMENT OF COMMERCE

Technical News Bulletin

of the

National Bureau of Standards

★ *Issued Monthly* ★

Washington DECEMBER 1939[1] Number 272

CONTENTS

Improvements in radio sonde.
Improved electric hygrometer.
Weakly active radium standards.
Zeeman effect in the second and third spectra of xenon.
Heat of fusion of ice.
Physical properties of purified trimethylpentane.
Polar structure of some benzein indicators.
Potentiometric method for measuring hydrogen-ion activity.
Aluminum ion and hydrogen ion in papers.
Effect of pouring temperature on properties of cast red brass.
Sonic method for studying effect of freezing and thawing on concrete.
Structural properties of "Nelson Pre-Cast Concrete Foundation" wall construction.
Structural properties of conventional wood-frame walls, partitions, floors, and roofs.
Use of plywood in wall construction.
Survey of roofing materials in the Northeastern States.
New and revised publications issued during November 1939.
Mimeographed material: Letter Circulars.
Recent Bureau articles appearing in outside publications.
Index to Technical News Bulletin 1939, Numbers 261 to 272, inclusive.

IMPROVEMENTS IN RADIO SONDE

Recently, a significant advance has taken place in weather forecasting, based on the routine collection of upper-air data to heights of 15½ miles by means of radio soundings. This method, developed at the Bureau, has supplanted the use of airplanes carrying calibrated recording instruments for securing upper-air data.

The radio-sonde system, as described in Technical News Bulletin 263 (March 1939), employs an instrument carried aloft on a small unmanned balloon, and ground-station receiving and recording equipment. The balloon instrument, or radio sonde, comprises elements for measuring barometric pressure, air temperature, and humidity; a radio transmitter and power supply; and means for impressing on the radio transmitter modulating frequencies which have predetermined relationships to the values of the factors measured. At the ground station, the frequencies of the received signals are measured and recorded automatically, thereby providing a plot of temperature and humidity against pressure.

A year's experimental use of the system during 1938–39 at 12 stations by the Navy Department, Weather Bureau, and Coast Guard provided data which exceeded both in regularity and accuracy the observations previously obtained by the airplane soundings. During the present fiscal year, the service is being expanded to include 30 land and 5 shipboard stations. One of the features of the experience with the radio-sonde system has been the excellent operation obtained by the shipboard stations.

An improved form of the radio sonde has been introduced at three of the stations and is to be used soon at six more stations. The essential improvement consists of the incorporation of a new device for measuring relative humidity, which utilizes the phenomenon of variation in conductivity of a hygroscopic salt when exposed to different relative humidities. In its operation as a resistor—the value of which varies with relative humidity—it parallels the temperature element

[1] Published with approval of the Director of the Budget.

used in the radio sonde, which functions as a resistor varying in accordance with the ambient temperature. The two measuring resistors and two fixed reference resistors are switched into the modulating oscillator of the radio sonde by a switch responding to changes in the ambient pressure. The modulating frequency is thereby controlled to provide measurements of pressure, temperature, and humidity.

IMPROVED ELECTRIC HYGROMETER

The wet- and dry-bulb psychrometer and hair-type hygrometer have long been used for determining the moisture content or relative humidity of air. There are, however, many possible applications for which these types of instruments have not been suitable. This is especially the case in measuring upper-air humidities by means of the radio sonde. Such an instrument, ascending rapidly, encounters very large and abrupt humidity changes, which occur too rapidly for the psychrometer or hair hygrometer to follow completely. Furthermore, these types of humidity indicators do not lend themselves readily to graphical recording or registering of humidity remote from the point of measurement; they are comparatively large and do not function well at very low temperatures.

A new type of electric hygrometer has recently been developed by Francis W. Dunmore, of the Bureau's Radio Section, and is described in the Journal of Research for December (RP1265). It has proved superior to other types for radio-sonde use because of its rapid response and ability to function at low temperatures. It may also be used for making and recording humidity readings when the humidity unit is remote from the point of indication. As it is comparatively small, it may be used for measuring humidities in confined spaces.

Although the device seems simple, it has required 2 years to bring it to the present stage of development. It now gives results accurate to within 2 or 3 percent.

The hygrometer consists of 2 fine palladium wires spirally wound about $\frac{1}{64}$ inch apart, 20 turns per inch, on a thin-walled aluminum tube which has a thin coating of polystyrene resin. This resin is one of the best-known water-resistant substances as well as an excellent electrical insulator. The wound unit is then covered with a very thin film of partially hydrolyzed polyvinyl acetate with the addition of a small amount of lithium chloride. The latter takes up water very rapidly, With such a device the electric resistance of the film between the two spiral coils is dependent upon the humidity of the air in contact with the film. The variations in resistance may change the audio note which the radio sonde transmits or may be made to operate a direct-reading ohmmeter with the resistance scale marked in terms of percentage of relative humidity.

There are definite reasons for each step in the development of the unit as given above. The thin-walled aluminum tube enables the unit to assume quickly the temperature of the air, the relative humidity of which it is to register; otherwise the indications will not be correct. The polystyrene film forms a surface of high electric resistance, which will not absorb water, upon which to wind the two palladium-wire coils. Absorbed moisture would cause a lag in the indications of the device. The palladium-wire coils remain fixed in their electrical properties, whereas units wound with wire of other metal (except platinum and gold) continue to vary from week to week because of some film forming on the surface of the wire. The thin polyvinyl-acetate film serves as the electric conductive medium. It has the property of taking on or giving off water very readily. It acts as a binder for the lithium chloride, which is the active material. This is one of the most hygroscopic salts. By controlling the amount of lithium chloride in the film, hygrometer units may be made with different degrees of sensitivity. By connecting several such units in parallel, each with suitable resistors in series, humidities from 10 to 100 percent may be measured.

WEAKLY ACTIVE RADIUM STANDARDS

At the request of the National Research Council Committee on Radioactive Standards, the Bureau has undertaken the preparation of a series of radium standards covering the weakly radioactive range equivalent to between 10^{-4} and 10^{-11} grams of radium. These standards are needed by investigators of the radioactive content of geological specimens, particularly of those used for determining the age of the earth. They are also needed in standardizing equipment for measuring artificial radioactivity.

The undertaking proved unusual in that the work could not be carried

out in the Bureau's regular radium-testing laboratories, or even in their immediate vicinity. The Bureau works chiefly with the relatively strong radioactive preparations used for medical purposes, which have to be stored nearby and which cannot be adequately screened; but even if this were not true, there is a possibility that they might "contaminate" the surroundings, so that the extremely sensitive instruments necessary for measuring the weak preparations are wholly unreliable.

A laboratory has consequently been equipped for this work, in an old residence—now included in the Bureau's grounds—located over 200 yards from the regular radium laboratories. The Bureau has prepared samples of finely ground rock, 12 different kinds, whose radioactivity will be measured and which will be used as standard samples of graded and specified radioactivity.

ZEEMAN EFFECT IN THE SECOND AND THIRD SPECTRA OF XENON

If a source of radiation is placed in a uniform magnetic field, the lines of the spectrum are split into a number of components. This phenomenon, called the Zeeman effect after its discoverer, was first observed in 1896, although Faraday and others had attempted similar experiments many years earlier. Lorentz was able to explain the simple normal triplet with the aid of classical electrodynamics, but it was not until the quantum theory of spectra was developed that the complicated patterns usually observed were fully accounted for. This explanation, first given by Lande, is one of the strongest pieces of evidence in favor of the theory. It turns out that from a fully resolved Zeeman pattern one can derive the quantum numbers characteristic of the energy states involved in the production of a spectrum line, or conversely if these quantum numbers are known, the pattern can be predicted. The Zeeman effect is, therefore, a powerful aid in the identification of the energy states of a radiating atom, or, in other words, in the term analysis of a spectrum.

In an investigation by Curtis J. Humphreys, William F. Meggers, and T. L. de Bruin, reported in the Journal of Research for December (RP1264), Geissler tubes containing xenon gas at low pressure were operated in a manner to emit the radiation from the various xenon ions; that is, a spark gap and condensers were placed in the discharge circuit. The source was placed between the poles of an electromagnet with the capillary portion of the tube at right angles to the field. A field strength of 36,000 gausses was maintained by a current of 150 amperes at about 100 volts. These experiments at the Bureau supplemented earlier observations at the "Physica" Laboratory in Amsterdam. In the earlier observations, the source consisted of a low-pressure chamber containing xenon through which a spark between metal electrodes was passed. Satisfactory agreement between the two sets of observations was obtained. Combining both sets of observations, Zeeman patterns were observed and measured for 130 lines of the second spectrum of xenon and for 62 lines of the third. The results have been interpreted and are found to support the previously published analyses.

HEAT OF FUSION OF ICE

The results of measurements of the heat of fusion of ice made at the Bureau and published in 1913 and 1915 have been revised by N. S. Osborne, one of the original experimenters, using more recent data for the heat capacity of water, which is involved in the calculations. The revised value, obtained by weighting the results of four independent series of measurements and expressed in terms of the present calorimetric unit of energy, is 333.5 international joules per gram with an estimated uncertainty of 0.2 int. j/g.

RP1260 in the Journal of Research for December will contain the complete account of this work.

PHYSICAL PROPERTIES OF PURIFIED TRIMETHYLPENTANE

In connection with an investigation of paraffin hydrocarbons being conducted at the Bureau for the National Advisory Committee for Aeronautics, the Navy Bureau of Aeronautics, and the Army Air Corps, a sample of 2,2,3-trimethylpentane was prepared synthetically, and was purified by fractionation in an automatically controlled 6-meter helix-packed column. The resulting product was of such purity that a good freezing point could be obtained.

The freezing point and melting point of this octane were determined by means of an apparatus in which the rate of cooling or heating was accurately controlled. At temperatures

near the freezing point of 2,2,3-trimethylpentane, any rate of temperature change from 0.8° C per minute cooling to over 1.5° C per minute heating was possible. A cooling rate of 0.12° C per minute could be maintained within 5 percent.

Other physical properties measured on this sample include boiling point and its variation with pressure, refractive index and density and their variations with temperature.

This work is described in RP1259 by Donald B. Brooks, Frank L. Howard, and Hugh C. Crafton, Jr., in the December number of the Journal of Research.

POLAR STRUCTURE OF SOME BENZEIN INDICATORS

In the study of electronic effects associated with changes of color of indicators the approximate electric moments have been measured by Myron A. Elliott and S. F. Acree for α-naphtholbenzein and thymolbenzein in benzene solution. As stated in RP1263 in the Journal of Research for December the values found for these moments were 4.3×10^{-18} and 6.8×10^{-18}, respectively, expressed in electrostatic units. These values are much lower than those predicted for the benzein type of molecule on the basis of a static dipolar structure, but they are compatible, on the other hand, with the quinone-phenolate resonance theory.

POTENTIOMETRIC METHOD FOR MEASURING HYDROGEN-ION ACTIVITY

The acidity or alkalinity of an aqueous solution depends upon the ratio of the activity of the hydrogen ions to the activity of the hydroxyl ions in the solution. When this ratio is unity, the solution is said to be neutral. A solution is acidic when this ratio is greater than unity and alkaline when this ratio is less than unity. As a rule, the activity of the hydrogen ions of solutions, especially those employed industrially, is low, varying from 10^{-1} to 10^{-14} moles or gram-atoms of hydrogen ions per liter. For convenience, the symbol pH is employed to designate the negative of the logarithm of the hydrogen ion activity. Most solutions employed industrially have pH values between 1 and 14.

The most accurate means for the measurement of the activity of hydrogen ions or the "effective acidity" are potentiometric methods. The present potentiometric methods involve certain factors which cannot be accurately evaluated. Using new equipment recently installed, Walter J. Hamer and S. F. Acree have developed a new potentiometric method from which factors that are difficult to evaluate have been eliminated, in which special features and precautions have been incorporated, and by which it is possible to determine pH values with a precision of 0.0003 pH unit. Electric instruments of high sensitivity are employed; and extreme care is taken to exclude air, carbon dioxide, and soluble impurities from the solutions, since these also contribute to acidity or alkalinity. Control of the temperature within 0.01°C is maintained. In this method, described in the Journal of Research for December (RP1261), hydrogen and silver-silver chloride electrodes are used in solutions to which known amounts of either sodium or potassium chloride have been added. The hydrogen electrode is the standard for measurements of acidity or alkalinity. The silver-silver chloride electrode replaces the calomel reference electrode and its salt bridge employed in the usual potentiometric methods. By its use, liquid junctions formed between the salt bridge of the calomel electrode and the solution being studied are avoided. This is a desirable feature of the method, since no means is now known by which the electrical potential produced at a liquid junction can be accurately measured or evaluated.

Data are given which illustrate the precision obtainable with the new equipment and method. On the average, the electromotive forces of the cells are reproducible to 0.02 millivolt, which is equivalent to 0.0003 pH unit. The hydrogen and silver-silver chloride electrodes exhibit no temperature hysteresis, do not change in potential with time, and exhibit no polarization effects. In the report it is also shown how the hydrogen-ion activity may be calculated from the electromotive force by thermodynamic methods, using the Nernst equation in which the concepts of activity and interionic attraction are incorporated.

ALUMINUM ION AND HYDROGEN ION IN PAPERS

It was recently reported in J. Research NBS 22, 553 (May 1939) RP1205, that a simple procedure for

the determination of the pH of papers, involving cold aqueous extraction, gives values which are as closely related to the amounts of alum used in manufacture and to the stabilities of the papers as are those obtained with methods employing hot extraction. The former, by virtue of its simplicity, eliminates the factors which apparently account for the rather poor reproducibility among laboratories using the standard method. Thus, the basis for preferring the procedure involving cold extraction was a practical one.

Further work has shown, however, that there is also a fundamental basis for preferring the method of cold extraction. Heating of the paper-water mixtures was found to increase greatly the hydrolysis of the aluminum salts in the papers, thereby producing as much as three to four times the amount of acid originally found in the cold extract. Such large amounts of acid obscure the effects of smaller amounts of other acids which may result from cooking or bleaching operations, or which may be present owing to polluted atmosphere, any of which are known to cause deterioration of papers.

The heating operation has a further serious drawback. Partial hydrolysis of the aluminum salts in papers with the liberation of harmful acid may take place when papers are stored or shipped under warm, humid conditions, or when the drying or other manufacturing processes were faulty. This acid cannot be detected by the method of hot extraction, since the heating process causes more or less complete hydrolysis, irrespective of any partial hydrolysis which may already have occurred. The method of cold extraction, on the other hand, gives pH values corresponding to the hydrolysis equilibrium at room temperature. If the aluminum salt has been already partially hydrolyzed by faulty storage or manufacturing conditions, the acid thus liberated is measured in the unheated extract.

If the acidity of a paper, as it exists under conditions of use, can be employed as a measure of permanence of paper, and it appears that this is true, then the method of cold extraction gives a much closer measure of the significant pH values of papers than do the more complicated methods now in general use.

The complete report of this study will appear as RP1262, by Herbert F. Launer, in the December number of the Journal of Research.

EFFECT OF POURING TEMPERATURE ON PROPERTIES OF CAST RED BRASS

In a paper before the Temperature Symposium of the Institute of Physics at the Hotel Pennsylvania, New York, on the evening of November 2, H. B. Gardner, Research Associate of the Non-Ferrous Ingot Metals Institute at the Bureau, described the procedures used in measuring the temperature of red brass during melting and casting. Illustrations were given of the differences in physical properties obtained in castings of this alloy poured at different temperatures.

The Non-Ferrous Ingot Metals Institute has sponsored this investigation since 1930. Technical research has been restricted to a study of effects of pouring temperature and of impurities on the physical properties of the widely used cast red brass of the nominal composition of 85 percent of copper and 5 percent each of tin, zinc, and lead.

It was necessary to devise a suitable method for measuring the temperature of the metal while in the furnace and also during pouring. In the earlier phases of the investigation pouring temperatures of 1,040°, 1,095°, 1,150°, 1,205°, and 1,260°C were used; but in the later work the pouring temperatures were restricted to 1,065°, 1,150°, and 1,230°C. It was found that the pouring temperature usually had a greater influence on the physical properties of the alloy than had certain intentionally added impurities.

SONIC METHOD FOR STUDYING EFFECT OF FREEZING AND THAWING ON CONCRETE

Various freezing and thawing tests have been developed in an attempt to find a rapid method for judging the resistance of building materials to weathering over an extended period. How to determine the extent of the deleterious action is one of the principal problems in such tests. Visual inspection and loss in weight have long been used, but they do not tell enough about changes within the specimen. Determination of the change in modulus of elasticity by the static method is considered very useful but has the disadvantage of being slow and injurious to the specimen.

Recently, methods have been developed for measuring certain natural frequencies of a test specimen. By

making use of the proportionality between the elastic modulus and the square of the natural frequency of a free-free bar vibrating in the fundamental flexual mode the modulus of elasticity of the specimen can be determined. In one variation of this method developed by F. B. Hornibrook, and now used at the Bureau, the specimen is vibrated at different frequencies until the frequency is found which corresponds to the natural frequency of the vibration of the specimen itself.

The results from this method were compared with strength changes of concrete specimens which had been subjected to freezing and thawing. The percentage decrease in modulus of rupture was found to be nearly equal to that in elastic modulus. The percentage decrease in compressive strength was, in general, considerably smaller.

STRUCTURAL PROPERTIES OF "NELSON PRE-CAST CONCRETE FOUNDATION" WALL CONSTRUCTION

Building Materials and Structures Report BMS26, which is now available, describes recent tests which were made at the Bureau on 18 specimens of a reinforced-concrete foundation wall construction marketed under the trade name "Nelson Pre-Cast Concrete Foundation," and submitted by the Nelson Cement Stone Co.

The specimens were subjected to compressive, transverse, concentrated, impact, and racking loads. The transverse, concentrated, and impact loads were applied to both faces of the specimens, simulating actual loads applied to the foundation walls of a house.

For each of the loads, three like specimens were tested. The deformation under load and the set after its removal were measured for uniform increments of load, except for concentrated loads, for which the set only was determined. The results are presented in graphs and in tables.

Copies of this report may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

STRUCTURAL PROPERTIES OF CONVENTIONAL WOOD-FRAME WALLS, PARTITIONS, FLOORS, AND ROOFS

As part of the program on the structural properties of low-cost house constructions, 39 specimens representing conventional wood-frame walls, partitions, floors, and roofs, which had been built at the Forest Products Laboratory of the U. S. Department of Agriculture, were recently tested at the Bureau. In addition, 6 wall frames without covering were tested. These tests provide data which will serve as a basis for comparison between the structural properties of these widely used constructions and those of newer and less-known types.

The wall-frame specimens were subjected to compressive and transverse loads; the wall and partition specimens to compressive, transverse, concentrated, impact, and racking loads; the floor specimens to transverse, concentrated, and impact loads; and the roof specimens to transverse and concentrated loads. The transverse, concentrated, and impact loads were applied to both faces of wall specimens. For each of these loads three like specimens were tested. The deformation under load and the set after the load was removed were measured, except for concentrated loads, for which the set only was determined. The results, which have just been published as Building Materials and Structures Report BMS25, are presented in graphs and in tables. The price per copy of this publication is 15 cents.

USE OF PLYWOOD IN WALL CONSTRUCTION

Because of the great increase in the production of plywood and a decrease in its cost, it is now finding many new uses. During the past few years, plywood has been made with water-resistant glues, and the product is being applied in house construction.

Tests to determine the structural properties of a wood-frame and plywood wall construction are described in Building Materials and Structures Report BMS30, which has just been released. The tests were made on speci-

mens representing walls submitted by the Douglas Fir Plywood Association of Tacoma, Wash. The walls were conventional 2- by 4-in. studs spaced 1 ft. 4 in. on centers. The outside face was 5/16-in.-thick Douglas-fir plywood, 3-ply-sheathing grade, bonded with water-resistant protein glue having a soybean and casein base. The inside face was finished by Douglas-fir plywood, wallboard grade. An oil stain is recommended for finishing the inside walls. Constructions of this kind can be built by any competent house builder, because he can use the methods to which he is accustomed for cutting and fastening the plywood.

Copies of BMS30 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

SURVEY OF ROOFING MATERIALS IN THE NORTHEASTERN STATES

H. R. Snoke and L. J. Waldron recently completed a survey of the weathering qualities and extent of use of roofing materials in 11 Northeastern States. The results are similar to those reported in Building Materials and Structures Report BMS6, Survey of Roofing Materials in the Southeastern States.

Detailed studies of the weathering characteristics of roofing materials were made in Wilmington, Del.; Philadelphia, Pa.; New Haven, Conn.; Boston, Mass.; Manchester, N. H.; Portland, Maine; Rutland, Vt.; and Albany and Syracuse, N. Y.

The results, which have just been published as Building Materials and Structures Report BMS29, include a tabulation by States of the kinds of roofing materials on more than 10,000 rural and small-town dwellings along approximately 1,600 miles of highway between the cities listed above, and a summary of the kinds of roofing materials used on almost 21,000 rural and small-town dwellings along 4,000 miles of highway in 20 Eastern States.

Frequent reference is made in this report to the survey in the Southeastern States. Observations concerning the effect of the hurricane of September 21, 1938, on many types of roofs are also included.

The report is illustrated by 48 photographs showing types of weathering of roofing materials and features of design and construction of roofs. These have been selected from more than 500 taken during the course of the survey.

A list of selected references to the literature on roofing materials is included.

Copies of BMS29 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

NEW AND REVISED PUBLICATIONS ISSUED DURING NOVEMBER 1939

Journal of Research[2]

Journal of Research of the National Bureau of Standards, volume 23, number 5, November 1939 (RP1252 to RP1258, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers[2]

[Reprints from the August and September 1939 Journal of Research]

RP1228. Measurements of heat capacity and heat of vaporization of water in the range 0° to 100° C. Nathan S. Osborne, Harold F. Stimson, and Defoe C. Ginnings. Price 10 cents.

RP1230. Electrophoresis of collagen. John Beek, Jr., and Arnold M. Sookne. Price 5 cents.

RP1231. The system PbO-B_2O_3-SiO_2. R. F. Geller and E. N. Bunting. Price 5 cents.

RP1232. Particle size and plasticity of lime. Dana L. Bishop. Price 5 cents.

RP1233. Quantitative formation of furfural and methylfurfural from pentoses and methylpentoses. Elizabeth E. Hughes and S. F. Acree. Price 5 cents.

RP1234. Electrophoretic studies of silk. Arnold M. Sookne and Milton Harris. Price 5 cents.

RP1235. Approximation to a function of one variable from a set of its mean values. Martin Greenspan. Price 5 cents.

RP1236. Preparation of crucibles from special refractories by slip-casting. John G. Thompson and Manley W. Mallett. Price 10 cents.

RP1237. Effects of humidity and composition on strength and Young's

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama and Venezuela; other countries, 70 cents and $4.50, respectively.

modulus of enamels. Dwight G. Moore and William N. Harrison. Price 5 cents.

RP1238. Saturation of gases by laboratory wet-test meters. Francis A. Smith and John H. Eiseman. Price 5 cents.

RP1241. Comparison of accelerated aging of record papers with normal aging for 8 years. B. W. Scribner. Price 5 cents.

RP1242. An apparatus for magnetic testing at magnetizing forces up to 5,000 oersteds. Raymond L. Sanford and Evert G. Bennett. Price 10 cents.

Building Materials and Structures [2]

[Persons who wish to be notified of new publications in the "Building Materials and Structures" series as soon as they are available should write to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

During the past month the following publications in this series have been issued:

BMS25. Structural properties of conventional wood-frame constructions for walls, partitions, floors, and roofs. George E. Heck. Price 15 cents.

BMS26. Structural properties of "Nelson Pre-Cast Concrete Foundation" wall construction sponsored by the Nelson Cement Stone Co., Inc. Herbert L. Whittemore, Ambrose H. Stang, and Cyrus C. Fishburn. Price 10 cents.

BMS29. Survey of roofing materials in the Northeastern States. Herbert R. Snoke and Leo J. Waldron. Price 10 cents.

BMS30. Structural properties of a wood-frame wall construction sponsored by the Douglas Fir Plywood Association. Herbert L. Whittemore and Ambrose H. Stang with the collaboration of Thomas R. C. Wilson, Forest Products Laboratory. Price 10 cents.

Technical News Bulletin [2]

Technical News Bulletin 271, November 1939. Price 5 cents. Annual subscription, 50 cents.

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela; other countries, 70 cents and $4.50, respectively.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC571. Optical instruments, refractometry, and optical glass: Publications. (List.) Supersedes LC485.)

LC572. Device for testing snag resistance of stockings.

LC573. Sound absorption coefficients of the more common materials. (Supersedes LC539.)

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [3]

Methods for inspecting pipe lines. K. H. Logan and E. A. Koenig. J. Am. Water Works Assn. (22 East 40th St., New York, N. Y.) **31**, 1451 (September 1939).

A comparison of methods for estimating the corrosivity of soils. K. H. Logan and E. A. Koenig. Preprint of paper presented at meeting of Am. Petroleum Inst. (50 West 50th St., New York, N. Y.) (Nov. 16, 1939.)

Comparing of calorimetric and polarographic methods for determining cystine in insulin. M. X. Sullivan, W. C. Hess, and E. R. Smith. J. Biol. Chem. (Yale University, New Haven, Conn.) **130**, 745 (October 1939).

The assignment of uncertainties to the data of chemistry and physics, with special recommendations for thermochemistry. F. D. Rossini and W. E. Deming. J. Wash. Acad. Sci. (450 Ahnaip St., Menasha, Wis.) **29**, 416 (October 1939).

Some of the paper problems in multicolor offset printing. C. G. Weber, Paper Trade J. (10 East 39th St., New York, N. Y.) **109** No. 16, 29 (Oct. 19, 1939).

Stability of leather as indicated by different Procter and Searle values and by pH values. R. C. Bowker and E. L. Wallace. J. Am. Leather Chemists Assn. (Ridgway, Pa.) **34**, 551 (October 1939).

The physical properties of sole leather. Part I. A comparison of machines for testing resistance to abrasion.

[3] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

D. J. Lloyd, R. C. Bowker, F. O'Flaherty, E. Norlin, J. G. Parker, and E. L. Wallace. J. Int. Soc. Leather Trades' Chemists (17 Leathermarket St., London, S.E. 1, England) **23**, 461 (August 1939).

Transformation of austenite on quenching high-purity iron-carbon alloys. T. G. Digges. Reprint 24, Am. Soc. Metals (7016 Euclid Ave., Cleveland, Ohio) (October 1939).

Clear light on moot electrical problems. Morton G. Lloyd. J. Electrical Workers and Operators (1200 Fifteenth St., N. W., Washington, D. C.), **38**, 510 (October 1939).

The head and eye protection code of the National Bureau of Standards. M. G. Lloyd. Nat. Soc. Prevention of Blindness, Pub. 296 (50 West 50th St., New York, N. Y.) (October 1939).

INDEX TO TECHNICAL NEWS BULLETIN 1939, NUMBERS 261 TO 272, INCLUSIVE

A

Page

Abrasive resistance of bricks 113
Absorption, internal, of gamma rays in radium, beryllium, neutron sources 117
Absorptions, difficult, bubbler tip of Pyrex glass 54
Accelerometers, new method of testing 2
Acid, perchloric or sulfuric, volatilization of metallic compounds from solutions in 35
Acidity of leather, effect on stability 67
Acids, organic, solubility of colored glazes in 37
Acrylic resins as denture base materials 85
Advisory committee on metallurgy, 1939 meeting 55
Aggregates, coarse, Simplified Practice Recommendation 74
Aging tests of record paper 95
Air capacitors, energy losses 59
Air-conditioning requirements of printing plants 116
Air permeability of bricks 73
Air-setting refractory mortars 18, 72
Air voids in fresh concrete, measurement 74
Aircraft fabrics, doped 27
Aircraft, thermal insulation 85, 96
Airplane-camera lenses, resolving power and distortion 53
Airplane dopes 94
Airplane electric systems, optimum voltage 106
Alloys for electric heating elements 58
Aluminum and antimony, effects on cast red brass 56
Aluminum ion in papers 126
Aluminum, polished, action of latex on 67
American Association of Physics Teachers, annual meeting 10
American Congress of Physical Therapy honors W. W. Coblentz 98
American Physical Society, annual meeting Dec. 27–29, 1938 10
American Physical Society, meeting of Apr. 27–29, 1939 42
Ampere absolute determination 43
Antarctic expedition, 1939 100
Antimony and aluminum, effects on cast red brass 56
Arabic manuscripts, fibers of old 13
Areas, cross-sectional, of structural members, determination 114

B

Backflow prevention in over-rim water supply fixtures 115
Balances, magnetic damping of, trouble with 118
Ball clays, American and English, base exchange capacities, effect of organic matter 107
Base-combining capacity of wool 47
Base exchange capacities of American and English ball clays, effect of organic matter 107
Bearing surfaces, measuring wear 48
Beenzin indicators, polar structures 126
Beryllium, radium neutron sources, internal absorption of gamma rays 117
Boards, buildings, properties of fiber 38
Boiler furnace slags 49
Book papers, experimental, printing tests 27
Boron in special glasses, determination 49
Bottles, solubility of glass used for making 112
Boundary layer, turbulence and 1
Brass, cast red, effect of pouring temperature on properties 127
Brass, cast red, effects of aluminum and antimony 56
Brick, building, standard tests of 17
Brick cavity-wall construction, structural properties 114
Brick-mortar joints, permeability and strength 38
Brick, porosities in different sections of a 18
Brick, reinforced and brick-tile cavity-wall constructions 114
Brick walls, structural properties 17
Bricks, abrasive resistance 113
Bricks, air and water permeability 73
Broadcast of standard of musical pitch 106
Bubbler tip of Pyrex glass for difficult absorptions 54
Building boards, fiber, properties 38
Building codes, preparation and revision 75

C

Cadmium-cadmium sulfate half-cell for measuring earth potentials 44
Cadmium coatings on steel, measuring thickness 91
Calendar reforms, proposed 96
CaO-Fe_2O_3-SiO_2, system 37
Calibration of large testing machine 103
Calking materials, plastic 19
Camera error, relation to photogrammetric mapping 14
Camera lenses, airplane, resolving power and distortion 53
Capacitors, air, energy losses 59
Cans for fruits and vegetables, proposed standard sizes 80
Carbon dioxide and ethylene oxide, analysis of mixtures 14
Carbon dioxide for extinguishing fires 99
Carbon, microchemical determination, handling hygroscopic substances 34
Carbon monoxide, heat and free energy of formation 35
Cartridges, metallic, simplification of varieties and classification 50
Cast iron, elastic properties 16
Cathode, dropping mercury, for estimation of cystine 54
Cellulose acetate sheeting for protection of documents 33
Cellulose fibers, fluidity test for quality 27
Cement clinker, portland, use of mineralizers in manufacture 84
Certification plan 79, 96
Chemistry and physics, assignment of uncertainties to the data of 87
Chinaware, fine crystal structure 8
Chlorine, second spectrum 96
Chromaticity-scale coordinates, rectangular uniform 14

	Page
Chromium-gold resistance alloy	43
Clamp, toggle, for rubber tensile specimens	46
Clay, plastic, relation between moisture content and flow-point pressure	29
Clays, ball, American and English, base exchange capacities, effect of organic matter	107
Clays, refractory, changes accompanying conversion into firebrick	93
Cleaning materials, new circular	102
Coarse aggregates, Simplified Practice Recommendation	74
Coating, zinc and cadmium, on steel, measuring thickness	91
Coaxial, helical wires, two, mutual inductance and force between	16
Codes, building, preparation and revision	75
Coils, improved, use, in determining absolute value of ampere	43
Collagen, electrophoresis	86
Color tolerances, specification	45
Color triangle, Maxwell	14
Colorimetric determination of rhenium and molybdenum	107
Colors, method of designating	94
Columns, laboratory rectifying, reflux regulator and head for	106
Commercial standard for domestic grades of Douglas-fir plywood	28
Commercial standard for Douglas-fir stock doors	29
Commercial standard for interchangeable ground-glass joints, stopcocks, and stoppers	64
Commercial standard for solid hardwood wall paneling	103
Commercial standard for woven dress fabrics	102
Compressive tests of thin-wall materials, "Pack" method	57
Concrete as X-ray protection	50
Concrete-block cavity-wall construction, performance	104
Concrete-block walls, structural properties	17
Concrete, effect of freezing and thawing, sonic method for studying	127
Concrete floors, relative wear resistance	112
Concrete-foundation wall construction, Nelson pre-cast	128
Concrete, fresh, measurement of air voids in	74
Cones and tubes, paper, simplification of sizes	119
Conference of State Utility Commission Engineers, seventeenth	60
Conference on Weights and Measures, Twenty-ninth National	63
Containers, silver-lined	56
Copper and lead, determination, in nitric acid solution	55
Copper-copper sulfate half-cell for measuring potentials in the earth	36
Copper rods, cold-worked, development of fibrous texture	56
Corrosion data, soil, engineering significance	6
Corrosion specimens, soil, removal	92
Corrosion studies, soil-corrosion-resistant materials and special tests	104
Corrosivity of soils, methods for estimating	115
Cosmic-ray observations in the stratosphere	118
Coverings, floor, indentation tests	48
Cross-sectional areas of structural members, determination	114
Crucibles for melting metals	57
Crucibles, preparation from special refractories by slip casting	83
Crystal structure, fine, of chinaware	8
Cystine, estimation of, by the dropping mercury cathode	54
Cystine in wool, photochemical decomposition	117

D

	Page
Dams, flashboards on	71
Density of glasses as a function of composition	37
Dental materials, hydrocolloidal impression	101
Denture base material, acrylic resins as	85
β-*d*-2-desoxygalactose, preparation and properties	34
Detector for radium	66
Diamond tool for indentation measurements	65
Dielectric constant, edge correction in determination	59
Diffraction patterns, X-ray, of rubbers	66
Diffusion, turbulence and	2
2,6-dimethylheptane, comparison with insononane	26
Distillation column, rotary, efficiency	45
Distortion of airplane-camera lenses	53
Dithizone, use in determining solubility of lead sulfate	6
Documents, protection of, with cellulose-acetate sheeting	33
Doors, stock, Douglas fir, commercial standard	29
Doped fabrics for aircraft	27
Dopes, airplane	94
Douglas-fir plywood, domestic grades, commercial standard	28
Douglas-fir-stock doors, commercial standard	29
Dress fabrics, woven, commercial standard	102
"Dun-Ti-Stone" wall construction, structural properties	104
Dye adsorption for indicating relative solubility of glass	6

E

	Page
Earth potentials, cadmium-cadmium sulfate half-cell for measuring	44
Earth potentials, copper-copper sulfate half-cell for measuring	36
Edge correction in determination of dielectric constant	59
Elastic properties of cast iron	16
Electric equipment and lines, safety rules for operation	10
Electric systems, airplane, optimum voltage	106
Electric heating elements, alloys for	58
Electric hygrometer, improved	124
Electrical Safety Code, National, part 4	10
Electricity, new units	42
Electrodes, silver-silver halide, reproducibility	26
Electrolysis measurements, cadmium-cadmium sulfate half-cell for	44
Electrolysis measurements, copper-copper sulfate half-cell for	36
Electrophoresis of collagen	86
Electrophoretic studies of silk	86
Electrophoretic studies of wool	102
Enamel frits, ground-coat, thermal expansion	16
Enamels, effects of humidity and composition	91
Ethylene oxide and carbon dioxide, analysis of mixtures	14
Expansion measurements, Fizeau interferometer for	66
Eyes, safety code for protection	10

F

	Page
Fabrics, doped, for aircraft	27
Fabrics, woven dress, commercial standard	102

	Page
"Fabrihome" constructions for walls and partitions, structural properties	20
Fiber building boards, properties	38
Fibers, cellulose, fluidity test for quality	27
Fibers, commercial, microscopic methods for identifying	54
Fibers of old Arabic manuscripts	13
Field-intensity measurements, radio	60
Film, photographic, for preserving records	68
Fire extinguishment with carbon dioxide	99
Firebrick, changes accompanying conversion of refractory clays into	93
Fizeau interferometer for expansion measurements	66
Flame proofing of textiles	47
Flashboards, tests	71
Floor coverings, indentation and recovery	48
Floor, steel, Keystone beam, properties	29
Floor, steel, Wheeling long-span, properties	48
Floors, concrete, relative wear resistance	112
Floors, "Frameless-Steel"	4
Floors, "Pre-Fab", structural properties	84
Floors, sound insulation	58
Floors, wood-frame, structural properties	128
Flow-point pressure and moisture content of plastic clay, relation between	29
Fluidity test for quality of cellulose fibers	27
Foundation wall construction, Nelson pre-cast concrete	128
Fractionation of petroleum	15
Frame, rigid, welded-steel, strength of	71
"Frameless-Steel" walls, partitions, floors, and roofs	4
Freezing and thawing, effect on concrete, sonic method for studying	127
Frequencies, radio, graphs of maximum usable	3
Frequencies, radio, maximum usable	60
Fruits, cans for, proposed standard sizes	80
Fuels for internal-combustion engines, knock rating	90
Function, approximation to a, of one variable from a set of its mean values	87
Fungicidal properties of silver	56
Furfural and methylfurfural, quantitative formation from pentoses and methylpentoses	85
Furnace, boiler, slags	49

G

	Page
Gamma rays, internal absorption, in radium, beryllium, neutron sources	117
Gas meters, wet, test, errors	90
Gases, permeability of neoprene to	8
Gasolines, knock rating	90
Geophysical research, role of hydraulic laboratories in	101
Glass electrode, effect of solubility of glass on behavior	25
Glass for making bottles, solubility	112
Glass phase and physical properties of whiteware bodies, effects of rate of heating	7
Glass, pyrex-platinum seals	64, 87
Glass, relative solubility, as indicated by dye absorption	6
Glass, solubility of, effect on behavior of glass electrode	25
Glasses, density as a function of composition	37
Glasses, special, determination of boron	49
Glassware, railroad signal	53
Glazes, colored, solubility in organic acids	37
Gold-chromium resistance alloy	43
Grinding wheels, sizes, simplification of	108
Ground-coat enamel frits, thermal expansion	16
Ground-glass joints, stopcocks, and stoppers, interchangeable, commercial standard	64
Guard-ring method of measuring dielectric constant	59

H

	Page
Half-cell, cadmium-cadmium sulfate, for measuring potentials in the earth	44
Half-cell, copper-copper sulfate, for measuring potentials in the earth	36
Handles, hickory, simplification of grades	119
Hardwood wall paneling, solid, commercial standard	103
Heads, safety code for protection	10
Heat and free energy of formation of water and of carbon monoxide	35
Heat capacity and heat of vaporization of water	89
Heat of fusion of ice	125
Heating, effects of rate, on glass phase and physical properties of whiteware bodies	7
Heating elements, electric, alloys for	58
Heats of combustion of tetramethylmethane and 2-methylbutane	35
Helical wires, coaxial, mutual inductance and force between	16
Heterostatic loading	4
Hickory handles, simplifications of grades	119
Humidity, effect on enamels	91
Hydraulic laboratories in geophysical research	101
Hydrocarbon, rubber, behavior in molecular still	46
Hydrocarbons, adsorption on silica gel	26
Hydrocolloidal impression materials for use in dentistry	101
Hydrogen-ion activity, potentiometric method for measuring	126
Hydrogen ion in papers	126
Hydrogen, microchemical determination, handling hygroscopic substances	34
Hygrometer, electric, improved	124
Hygroscopic substances in the microchemical determination of carbon and hydrogen	34

I

	Page
Ice, heat of fusion	125
Impression materials, hydrocolloidal, for use in dentistry	101
Indentation measurements, diamond tool for	65
Indentation tests of floor coverings	48
Inductance, mutual, and force between two coaxial helical wires	16
Industrial uses for silver	56, 81
Inspection methods for pipe lines	72
Insulating material, dielectric constant	59
Insulation, sound, of walls and floors	58
Insulation, thermal, for aircraft	85, 96
Interferometer, Fizeau, for expansion measurements	66
Interferometer for measuring dimensional changes in rubber	116
International Scientific Radio Union and Institute of Radio Engineers, joint meeting	60
International Temperature Scale, and some related physical constants	36

Page

Ionization in the ionosphere and sunspot numbers, correlation between 87
Ionosphere storms 60
Iron-carbon alloys, high-purity, transformation during quenching 70
Iron, cast, elastic properties 16
Iron, high-purity, preparation 70, 107
Iron, second spectrum, pressure displacements 69
Isononane, comparison with 2,6-dimethylheptane 26

J

Joint fillers for masonry 19
Joints, brick-mortar, permeability and strength 38
Joints, ground-glass, interchangeable, commercial standard 64

K

Keystone beam steel floor, properties 29
Knock rating, the precision of 90

L

Latex, action on polished aluminum 67
Lead and copper, determination in nitric acid solution 55
Lead sulfate, solubility in solutions of sulfuric acid 6
Leather, deterioration, influence of natural nontannins 86
Leather, shrinkage temperature 67
Leather, stability 67
Lenses, airplane-camera, resolving power and distortion 53
Light, new units of 42
Light-weight structures 4
Lime, particle size and plasticity 84
Lithography, offset paper, manufacture 108
Loading, heterostatic 4
Low-temperature scale for calibrating thermometers 25
Lukenweld rigid steel frame, strength of 71
Lungs, safety code for protection 10

M

Magnetic damping of balances, trouble with 118
Magnetic-testing apparatus 94
Manuscripts, old Arabic, fibers of 13
Mapping, photogrammetric, relation of camera error to 14
Masonry walls, permeability 5
Masonry walls, structural properties 17
Materials, thin-wall, "pack" method of compressive tests 57
Maxwell color triangle, modified 14
Mercury cathode, dropping, for estimation of cystine 54
Metallic compounds, volatilization from solutions in perchloric or sulfuric acid 35
Metallurgical advisory committee, 1939 meeting 55
Metals, crucibles for melting 57
Meteorograph, improved, on Olland principle 3
Meter, radium exposure, designed as protective device 105
Meter, stratosphere ultraviolet 24
Meters, gas, wet, test, errors 90
2-methylbutane, heat of combustion 35
Methylfurfural, formation of methylpentoses 85
Microchemical determination of carbon and hydrogen, handling hygroscopic substances in 34
Microscopic methods for identifying commercial fibers 54
Mineralizers, use, in manufacture of portland cement clinker 84

Page

Mirrors of polished aluminum, action of latex on 67
Moisture content and flow-point pressure of plastic clay, relation between 29
Molybdenum and rhenium, separation and colorimetric determination 69, 107
Mortar joints in brickwork, permeability and strength 38
Mortars, air-setting refractory 18
Mortars, refractory-bonding, air-setting 72
Musical pitch, standard, continuous broadcast 100

N

National Bureau of Standards as a service organization 41
National Electrical Safety Code, part 4 10
Nelson pre-cast concrete foundation wall construction 128
Neoprene permeability to gases 8
Neutron, radium-beryllium sources, internal absorption of gamma rays 117
Nitric acid solution, determination of copper and lead in 55
Nontannins, natural, influence on deterioration of leather 86
Northeastern States, survey of roofing materials 129

O

Offset paper, experimental manufacture 108
Olland principle, meteorograph 3
Optical dispersion of rubber 96
Organic matter, effect on base exchange capacities of American and English ball clays 107
Oxidation of steels, rate of 71
Oxygen of high purity, preparation of 25
Ozone in the stratosphere, distribution 44
Ozone in the stratosphere, instrument for measuring 60

P

"Pack" method for compressive tests of thin-walled materials 57
Paneling, wall, solid hardwood, commercial standard 103
Paper cones and tubes, simplification of sizes 119
Paper, offset, experimental manufacture 108
Paper, old Arabic 13
Paper, record, comparison of accelerated and normal aging 95
Papers, aluminum ion and hydrogen ion in 126
Papers, book, experimental, printing tests 27
Papers, determination of pentosans in 33
Papers, pH values of 47
Particle size and plasticity of lime 84
Partitions, "Fabrihome" construction 20
Partitions, "Frameless-Steel" 4
Partitions, "Pre-Fab," structural properties 84
Partitions, wood-frame, structural properties 128
PbO-B_2O_3-SiO_2, the system 83
PbO-SiO_2, the system, X-ray studies of compounds 105
Pentosans, determination in pulps and papers 33
Pentoses, quantitive formation of furfural from 85
Perchloric acid, volatilization of metallic compounds from solutions in 35
Permeability and strength of brick-mortar joints 38

Page

Permeability of bricks, air, and water 73
Permeability of masonry walls 5
Permeability of neoprene to gases 8
Permeability of organic polysulfide resins to hydrogen 83
Petroleum fraction, midcontinent, composition 15
Petroleum, fractionation of 15
Petroleum fractions, comparison 26
pH values of papers 47
Photochemical decomposition of the cystine in wool 117
Photogrammetric mapping, relation of camera error to 14
Photographic film for preserving records 68
Physical constants related to International Temperature Scale 36
Physical Society, American, annual meeting Dec. 27–29, 1938 10
Physical Society, American, meeting of Apr. 27–29, 1939 42
Physics Teachers, American Association, annual meeting, Dec. 28–30, 1938 10
Pipe, buried, removal of specimens 92
Pipe-line inspection methods 72
Plastic calking materials 19
Plasticity and particle size of lime 84
Platinum-pyrex glass seals 64, 87
Plumbing systems, backflow prevention in 115
Plywood, Douglas fir, domestic grades, commercial standard 28
Plywood, use of, in wall construction 128
Polar structure of some benzein indicators 126
Polishing materials, new circular 102
Porosities in different sections of a brick 18
Portland cement clinker, use of mineralizers in manufacture 84
Potentials in the earth, a cadmium-cadmium sulfate half-cell for measuring 44
Potentials in the earth, a copper-copper sulfate half-cell for measuring 36
Potentiometer of high accuracy 36
Potentiometric method for measuring hydrogen ion activity 126
Pouring temperature, effect of, on properties of cast red brass 127
"Pre-Fab" walls, partitions, and floors, structural properties 84
Preservation of records on photographic film 68
Pressure displacements in second spectrum of iron 69
Printing plants, refrigeration and air-conditioning requirements 116
Printing tests of experimental book papers 27
Protection of documents with cellulose-acetate sheeting 33
Protection, X-day, economic features 50
Pulps, determination of pentosans in 33
Pure iron 107
Pyrex-platinum glass seals 64, 87

Q

Quality in textiles, tests for 95
Quenching of high-purity iron-carbon alloys, transformation during 70

R

Radio field-intensity measurements 60
Radio frequencies, graphs of maximum usable 3
Radio sonde, the 23, 123
Radio soundings and weather prediction 23, 123
Radio Union, International Scientific, and Institute of Radio Engineers, joint meeting 60

Page

Radium, beryllium, neutron sources, internal absorption of gamma rays in 117
Radium detector, improved 66
Radium exposure meter designed as protective device 105
Railroad signal glassware 53
Record paper, comparison of accelerated and normal aging 95
Records, preservation of, on photographic film 68
Rectangular uniform-chromaticity-scale coordinates 14
Rectifying columns, laboratory, reflux regulator and head for 106
Reflectivity, spectral, of rhodium 9
Reflux regulator and head for laboratory rectifying columns 106
Refractive index of rubber 96
Refractories, special, for use in preparation of crucibles by slip casting 83
Refractory-bonding mortars and air-setting 72
Refractory clays, changes accompanying conversion into firebrick 98
Refractory crucibles for melting metals 57
Refractory mortars, air-setting 18
Refrigeration and air-conditioning requirements of printing plants 116
Regulator, reflux, and head for laboratory rectifying columns 106
Resistance alloy, gold-chromium 43
Resolving power of airplane-camera lenses 53
Respiratory organs, safety code for protection 10
Rhenium and molybdenum, separation and colorimetric determination 69, 107
Rheology, Society of, annual meeting 101, 111
Rheology, symposium on 101
Rhodium, spectral reflectivity 9
Rigid frame, welded-steel, strength of 71
Roofing materials in the Northeastern States, survey 129
Roofing materials in the Southeastern States, survey 20
Roofs, "Frameless-Steel" 4
Roofs, wood-frame, structural properties 128
Rotary distillation column, efficiency 45
Rubber compounds, tensile properties 117
Rubber, crystalline sol, prepared from ethereal solution, X-ray diffraction pattern 8
Rubber, dimensional changes, interferometer for measuring 116
Rubber hydrocarbon, behavior in molecular still 46
Rubber latex, action on polished aluminum 67
Rubber, optical dispersion 96
Rubber tensile specimens, toggle clamp for 46
Rubbers, X-ray diffraction patterns 66

S

Safety code for heads, eyes, and respiratory organs 10
Safety rules for operation of electric equipment and lines 10
Service organization, National Bureau of Standards as a 41
Shells, paper shot, simplification of sizes and varieties 39
Shipping tags, simplification 50
Shrinkage temperature of leather 67
Signal glassware, railroad 53
Silica gel, adsorption of hydrocarbons on 26
Silk, electrophoretic studies 86
Silver, industrial uses for, ninth progress report 81
Silver-lined containers 56

Page

Silver Research Project to be continued 51
Silver-silver halide electrodes, reproducibility 26
Simplification of grades of hickory handles 119
Simplification of shipping tags 50
Simplification of sizes and varieties of paper shot shells 39
Simplification of sizes of grinding wheels 108
Simplification of sizes of paper cones and tubes 119
Simplification of varieties and classification of metallic cartridges 50
Simplified Practice Recommendation for coarse aggregates 74
Slags, boiler-furnace 49
Slip-casting for preparing crucibles from special refractories 83
Snow temperatures and densities, measuring 100
Society of Rheology, annual meeting 111
Soil-corrosion data, engineering significance 6
Soil-corrosion specimens, removal 92
Soil-corrosion studies, 1937—Corrosion-resistant materials and special tests 104
Soils, corrosivity, methods for estimating 115
Solubility of colored glazes in organic acids 37
Solubility of glass, effect of, on behavior of glass electrode 25
Solubility of glass, relative, as indicated by dye adsorption 6
Solubility of glass used for making bottles 112
Solubility of lead sulfate in solutions of sulfuric acid 6
Sonde, radio 23, 123
Sonic method for studying effect of freezing and thawing on concrete 127
Sound insulation of walls and floors 58
Southeastern States, survey of roofing materials 20
Specification for hydrocolloidal impression materials for use in dentistry 101
Specification of color tolerances 45
Spectra, second and third, of xenon, Zeeman effects in 125
Spectral reflectivity of rhodium 9
Spectrochemical analysis, list of publications 24
Spectrum of chlorine, second 96
Spectrum of iron, second, pressure displacements 60
Spectrum of xenon, second 9
State Utility Commission Engineers, seventeenth conference (1939) 60
Steam, thermal properties 89
Steel floor, Keystone beam, properties 29
Steel, zinc, and cadmium coatings, measuring thickness 91
Steels, oxidation, rate of 71
Still, molecular, behavior of rubber hydrocarbon in 46
Stone-concrete block walls, structural properties 17
Stopcocks and stoppers, ground-glass, interchangeable, commercial standard 64
Stratosphere, cosmic-ray observations in 118
Stratosphere, ozone in, distribution 44
Stratosphere ultraviolet meter 24
Structural Clay Products Institute's wall constructions 114
Structural members, determination of cross-sectional areas 114
Structural properties of brick cavity-wall construction 114
Structural properties of "Fabrihome" constructions for walls and partitions 20

Page

Structural properties of "Frameless-Steel" walls, partitions, floors, and roofs 4
Structural properties of masonry walls 17
Structural properties of "Pre-Fab" walls, partitions, and floors 84
Structures, light-weight 4
Sugar, β-d-2-desoxygalactose, preparation and properties 34
Sulfuric acid, volatilization of metallic compounds from solutions in 35
Sulfuric acid, solubility of lead sulfate in solutions of 6
Sunspot numbers and ionization of ionosphere, correlation between 87
System CaO-Fe_2O_3-SiO_2 37
System PbO-B_2O_3-SiO_2 49
System PbO-SiO_2, X-ray studies of compounds 105

T

Tags, shipping, simplification 50
d-talose, action of baker's yeast on 34
Temperature Scale, International, and some related physical constants 36
Temperature scale, low, establishment of, for calibrating thermometers 25
Tensile properties of rubber compounds 117
Tensile specimens, rubber, toggle clamp for 46
Testing machine, large, calibration 103
Tetramethylmethane, heat of combustion 35
Textiles, flameproofing 47
Textiles, tests for quality 95
Thermal expansion of ground-coat enamel frits 16
Thermal insulation for aircraft 85, 96
Thermal properties of steam 89
Thermochemistry, assignment of uncertainties to the data of 118
Thermochemistry, specific recommendations for, in assignment of uncertainties 87
Thermometers, establishment of a low-temperature scale for calibrating 25
Thermometers for measuring snow temperatures 100
Thickness of zinc and cadmium coatings on steel, measuring 91
Tile, brick-, cavity-wall constructions 141
Tile walls, structural properties 17
Torque between concentric single-layer coils 43
Trimethylpentane, purified, physical properties 125
Turbulence and diffusion 2
Turbulence and the boundary layer 1
Twenty-ninth National Conference on Weights and Measures 63

U

Ultraviolet meter, stratosphere 24
Uncertainties, assignment of, to data of chemistry and physics 87, 118
Units of electricity and light, new 42
Utility Commission Engineers, State, Seventeenth Conference (1939) 60

V

Variable, approximation to a function of one, from a set of its mean values 87
Vegetables, cans for, proposed standard sizes 80
Volatilization of metallic compounds from solutions in perchloric or sulfuric acid 35
Voltage, optimum, of airplane electric systems 106

W

	Page
Wall construction, brick cavity-, structural properties	114
Wall construction, concrete-block cavity-, performance	104
Wall construction, "Dun-Ti-Stone", structural properties	104
Wall construction, foundation, Nelson pre-cast concrete	128
Wall construction, use of plywood in	128
Wall construction, reinforced-brick and brick-tile cavity-	114
Wall paneling, solid hardwood, commercial standard	103
Walls, "Fabrihome" construction	20
Walls, "Frameless-Steel"	4
Walls, masonry, permeability	5
Walls, masonry, structural properties	17
Walls, "Pre-Fab", structural properties	84
Walls, sound insulation	58
Walls, wood-frame, structural properties	128
Washing, cleaning, and polishing materials, new circular	102
Water and steam, thermal properties	89
Water, heat and free energy of formation	35
Water permeability of bricks	73
Water supplies, over-rim, backflow prevention in	115
Wear of bearing surfaces, measuring	48
Wear resistance, relative, of concrete floors	112
Weather forecasting by radio	23, 123
Weather prediction based on radio soundings	23
Weights and Measures, National Conference, Twenty-ninth	63
Welded-steel rigid frame, strength of	71
Wet gas meters, errors	90
Wheeling long-span steel floor, structural properties	48
Wheels, grinding, sizes, simplification of	103
Whiteware bodies, glass phase and physical properties, effects of rate of heating	7
Willing-to-certify sources of supply of commodities	79
Wires, two coaxial helical, mutual inductance and force between	16
Wood-frame walls, partitions, floors, and roofs, structural properties	128
Wool, base-combining capacity	47
Wool, cystine in, photochemical decomposition	117
Wool, electrophoretic studies of	102
World-calendar plan	96
Wright Brothers Lecture, Dec. 17, 1938	1

X, Y, Z

	Page
Xenon, second spectrum	9
Xenon, second and third spectra, Zeeman effects in	125
X-ray diffraction patterns of crystalline sol rubber prepared from ethereal solution	8
X-ray diffraction patterns of rubbers	66
X-ray protection, economic features	50
X-ray studies of compounds in the system PbO-SiO_2	105
Yeast, baker's, action on *d*-talose	34
Zeeman effects in the second and third spectra of xenon	125
Zinc coatings on steel, measuring thickness	91

U. S. GOVERNMENT PRINTING OFFICE: 1939

Page
71
90
48
103
7
79
16
128
47
117
102
96
1
9
125
8
66
50
105
34
125
91